TECHNICAL MEMORANDUM

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Changes to Function TIME for Program 162

By

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PREFACE

This document is intended to be primarily a description of changes made to the program TIME, rather than an elaborate description of the program.

Acknowledgment is made to R. K. Siersbeck, TWRDE for portions of a rough draft proposal on several of the changes covered herein.

In comparison, the new method has the following advantages:

(1) Timer tables of an unlimited length are handled without jeopardizing the rapidity of the computer operation.

(2) The function *TIME is the only function that has been modified, to any degree.

A second requirement for the function *TIME is that it be able to simulate a resumption of Fairchild Timer activity after a period of non-activity. This necessitates having the capability of resetting the last active subcycle to any given reset time.

II. Program operations prior to modification

To illuminate adequately the method by which the function *TIME has been changed, it is necessary to relate briefly the manner in which this function was formerly used.

At the beginning of flight support, nominal resets are written. One file of the reset tapes, file 3, contains the events associated with the Fairchild Timer. The write nominal reset tape function (*WNRT) obtains file 3 information from a BCD tape called the "DATA PACKAGE." The information content of a Timer Table of 1500 events, at this stage of the operation, is in the form of 1500 BCD command identifiers and 1500 associated tape times. The first actual *TIME function relative to the timer is executed after the various Time of Events from the launch phase are reported and made known to the program. This first *TIME function is the "initial update." The "initial update" recomputes all the tape times and writes them on the reset tape in floating machine system times which reflects the reported jump time (lift-off time) of the vehicle. All subsequent Timer functions are termed "Orbital Updates" and reflect various events such as reset times and step setting. "Orbital Updates" are for the purpose of simulating an image of the timer status aboard the vehicle and to maintain geophysical position of command event occurrences.

In the event that the Timer on board the vehicle is non-cyclic, the commands appearing in the subcycles previous to the most recent reset are assumed to be past history and are omitted from the timer summary listing. These obsolete commands events, so to speak, however, are not eliminated from the timer tables and are carried on the reset tapes through the duration of the operation, although in truth they serve no useful purpose after their occurrence. The position of each command and BCD identifier relative to the timer table and reset tape image is not altered by this operation.

When the vehicle on board is a cyclic timer, the timer tables are cycled, simulating the phenomena which occurs on board the vehicle. In this instance, commands occurring on the subcycles previous to the subcycle of the present reset are not eliminated from printout. The commands in this instance physically changes position within the tables. An example of this phenomena can be seen by the following:

Cyclic Timer

Before Reset	Reset on Subcycle 3
Subcycle 1	Subcycle 3
Subcycle 2	Subcycle 4
Subcycle 3	Subcycle 5
	Subcycle n
	Subcycle 1
Subcycle n	Subcycle 2

All commands are listed and the command times for subcycle 1 and 2 will be modified to simulate their time of occurance after subcycle n.

Subcycles 1 and 2 in the cycle timer situation will act as subcycles n+1 and n+2 after a reset has been executed on subcycle 3.

The modification to the timer system mentioned herein, will not and should not in any way affect the method by which the cyclic timer is simulated. This capability, although presently not used is available for use whenever the need arises.

III. Description of the modifications

(1) The data package preparation program (*SPDPT) has been changed to give the timer commands a new format on the data package tape. Rather than having 1500 BCD commands followed by 1500 BCD decimal Times, there are just 1500 card image records. Each record has a command and its associated on or off time.

For example:

field	LOC.	OP	B	Address	Remarks
record	SPC1844	BCD		2 BCN 0 561874.	
column	1	10		20 29 36	

It will be noticed that the old Timer package tag (TIM) has been replaced with a new tag (SPC).

(2) *WNRT has been modified to bypass the writing of Timer commands on the reset tape. This is done by checking for the tag SPC in the data package. After a WNRT run, file 3 of the reset tapes contain just the Timer parameters, TIM 3001 and above. The remainder of the file is set to zero. WNRT will still, however, process TIM1 - TIM 3000 in the old format if necessary.

(3) The *TIME 3 3 function has been modified to perform the same task as *WNRT formerly did for file 3, in addition to its old duties.

An *TIME 3 3 function card will cause a serch of the data package tape to be made for the command SCY 1. On finding this command the function will commence reading in each record, separating the commands from their times, and storing the commands in the table TCOMMAND. The times are converted to floating point and are stored in the table COMMANDT.

This process continues until the 1500 cell tables are filled or an end card record is encountered. If an end card record is encountered, the function goes into the routines for adjusting command times relative to launch and timer delay time and for outputing the Timer Summary Table. Finally, file 3 of the reset tapes is updated with the timer tables. If, instead, the 1500 cells were filled, a search from the bottom of TCOMMAND is made for the last SCY command. A termination word (377777777777777) is placed in this location and all following cells are zeroed out. This assures the greatest integral number of subcycles possible in the timer tables. Once again, the program then goes into its updating and output routines.

(4) Depending on the number of commands in the data package, the initial update may only update a fraction of the total timer commands. Each time an orbital update (*TIME 3 2) is made, there will be an on-line printout. This will tell the current subcycle, that containing the latest reset time, and the final subcycle in the Timer Tables. As the current subcycle approaches the final subcycle there is needed a means of bringing in additional subcycles from the data package tape.

A new option of *TIME called the follow-on-initial update (*TIME 3 4) satisifies this need.

An *TIME 3 4 function card will cause the program to move the current subcycle to the top of the timer tables with no changes. A search of the data package is then made for the next subcycle. When this is found, the program will commence reading in each record, separating the commands from their times, and storing the commands in the table, TCOMMAND. The starting point in TCOMMAND is the first location after the last command of the current subcycle. The times are converted to floating point and stored in the corresponding locations of table COMMANDT. As in *TIME 3 3, this process continues until the 1500 cell tables are filled or an end card record is encountered. The termination procedures discussed under *TIME 3 3 are then followed.

At this point a need arises for an update to reflect in the new subcycles both the initial update and all steps, resets, skips, and repeats which have been made since the initial update. This is accomplished by applying the following formula to the new command times:

$X^1 = (X - A) P/_{P1} + B + P$

where:

X^1 = New updated command time
X = Uninitialized command time
A = Uninitialized time of the first new command
P = Current timer period (COMSMTT)
P^1 = Original tape period (TAPPEROD)
B = SCY time of the currently active subcycle

e.g. A follow-on-initial is made with the time of the latest reset occuring in subcycle 85. In this case "A" would be the subcycle start time of subcycle 86 as brought in from the data package tape. "B" would be the subcycle start time of subcycle 85 as exists in core. "X" would take on the value of each new command time brought in from the data package, and "X^1" would be the updated time of each new command after application of the formula.

(5) Since *WNRT no longer handles the Timer Tables, the *WNRT 0 0 option to enter changes by card to the timer package can no longer be used. *TIME has been modified to handle this task. If changes are required during an initial update, *TIME A 3 3 1 rather than *TIME A 3 3 0 is used. If the changes are required during a follow-on - initial then *TIME A 3 4 1 rather than *TIME A 3 4 0 is used. The function cards will be followed by symbolic cards in the same format as the data package. The change cards must be in ascending sequence by SPC Number and must be followed by a symbolic end card. The program reads in the first corrector card and compares the SPC number of each incoming record from tape with the SPC number of the card. When a compare is found the card data rather than the tape data is used and the next

card is read in. This process continues until the end card is encountered. The program then resumes operation without corrector procedures. If nothing other than an initial update has been performed, another initial update may be performed to make additional changes. If orbital updates have been made, the follow-on-initial option must be used to enter changes. There is no limit to the number of times the follow-on-initial update may be made.

(6) To fulfill the requirement for simulating periods of deactivization of the Fairchild Timer, the following modification was necessary.

Two additional parameters were added to the orbital update (*TIME 3 2) function card.

Program-wise, a search of the table TCOMMAND is made for the specified subcycle. Upon finding this subcycle, a search is made within the subcycle for an RMN event. Since there may be more than one RMN event the second of the two new parameters indicates which RMN within the subcycle one wishes to reset about. The time of this RMN event is then set to the entered time and all other command times are adjusted accordingly, around the new reset time.

In essence this modification gives the program the following capability. After deactivating the Fairchild Timer in rev A during subcycle B, it is possible to reactivate in rev D still using subcycle B.

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